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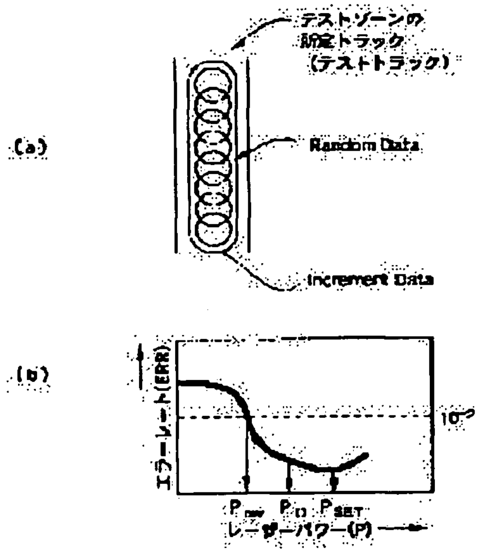
(54) SETTING METHOD OF LASER POWER AND RECORDING AND REPRODUCING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide the setting method of a laser power and a recording/ reproducing device giving an optimum laser power at the time of recording data in an optical disk capable of overwriting.
SOLUTION: Increment data are written in a test track with a laser power being initially set. Random data are overwritten in the test track in which the increment data are written and the error rate of the random data is detected. When the error rate is larger than a prescribed value, the write processing of random data is repeated by increasing the laser power. When the error rate reaches the prescribed value, the laser power POW at that time is multiplied by e.g. 1.2 times and is set to be a laser power at the time of writing data in the data recording area of the optical disk.



LEGAL STATUS

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[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

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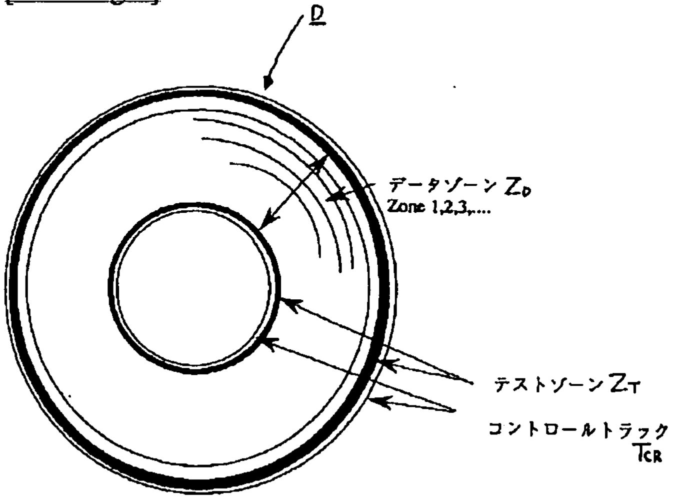
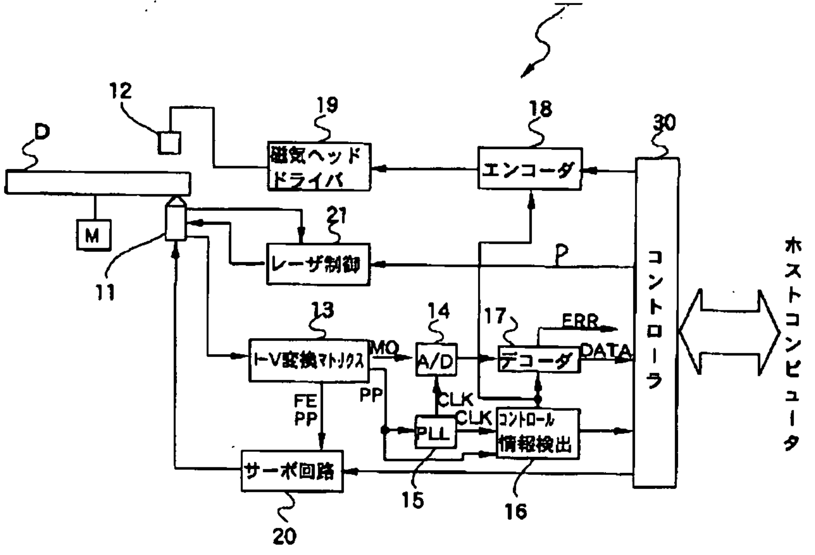
DRAWINGS

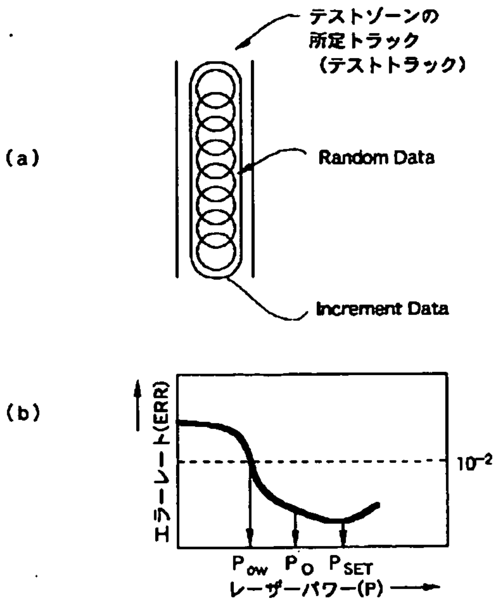
[Drawing 1]


D
データゾーン Z_D
Zone 1,2,3,....
テストゾーン Z_T
コントロールトラック T_{CR}

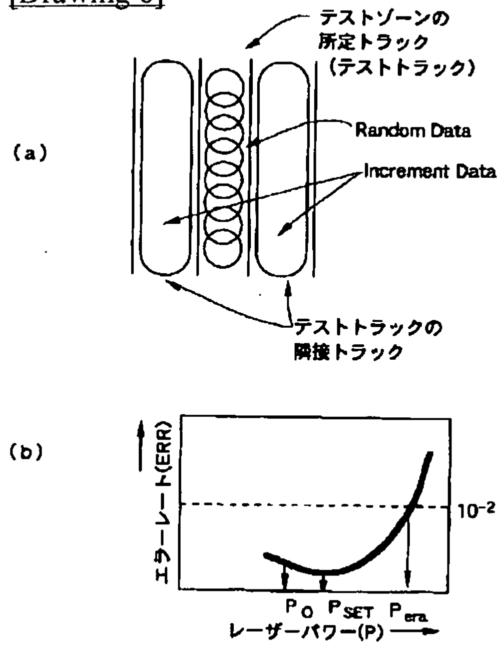
[Drawing 2]


10
12
D
19
磁気ヘッドドライバ
18
エンコーダ
30
M
21
レーザ制御
P
11
コントローラ
ホストコンピュータ
13
14
17
ERR
I-V変換マトリクス
MO
A/D
デコーダ
DATA
FE
PP
PP
CLK
CLK
PLL
コントロール情報検出
サーボ回路
15
16
20

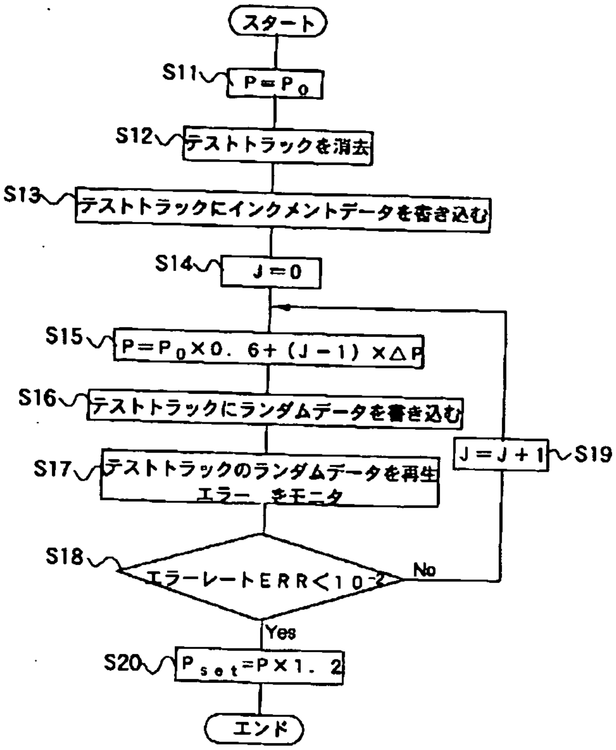
[Drawing 4]


テストゾーンの
所定トラック
（テストトラック）
(a)
Random Data
Increment Data
(b)
エラーレート(ERR)
10-2
Pow
PO
PSET
レーザーパワー(P)

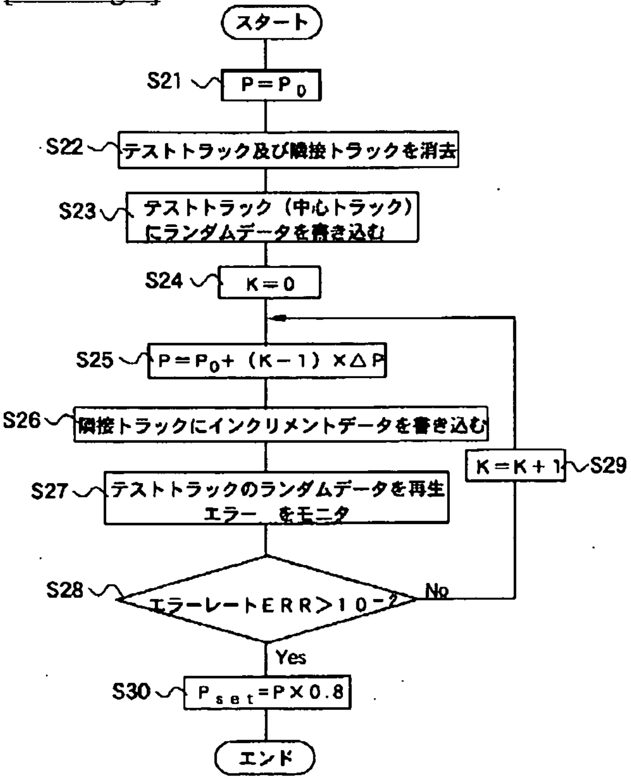
[Drawing 6]


テストゾーンの
所定トラック
（テストトラック）
(a)
Random Data
Increment Data
テストトラックの
隣接トラック
(b)
エラーレート(ERR)
10-2
PO
PSET
Pera
レーザーパワー(P)

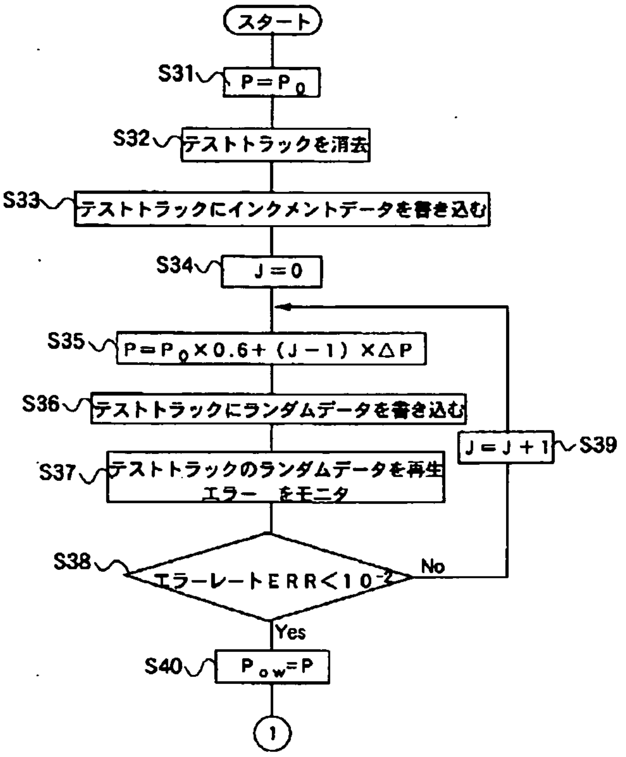
[Drawing 3]


スタート
S11
P=P0
S12
テストトラックを消去
S13
テストトラックにインクメントデータを書き込む
S14
J=0
S15
P=P0×0．6+（J−1）×ΔP
S16
テストトラックにランダムデータを書き込む
S17
テストトラックのランダムデータを再生
エラー　をモニタ
S18
エラーレートERR<10-2
No
Yes
S19
J=J+1
S20
Pset=P×1．2
エンド

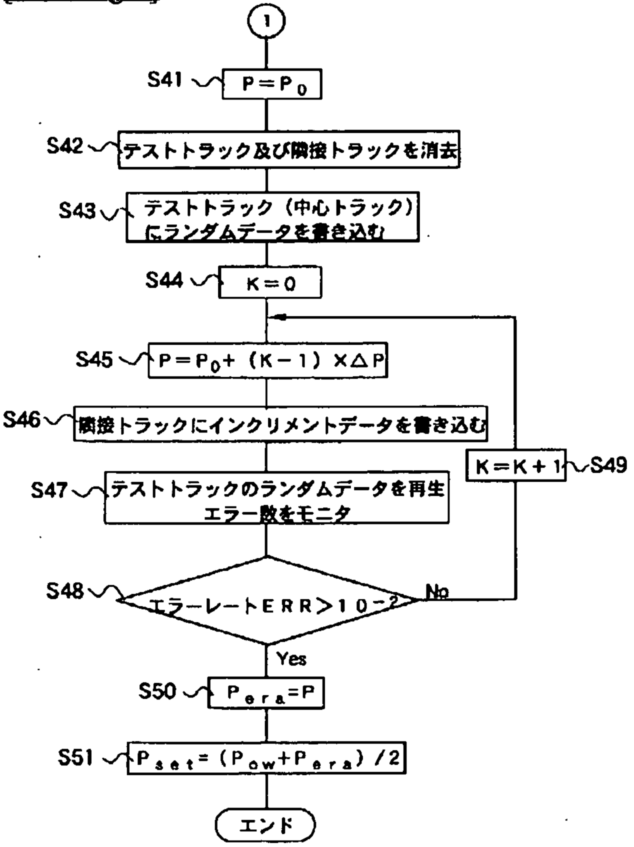
[Drawing 5]


スタート
S21
P=P0
S22
テストトラック及び隣接トラックを消去
S23
テストトラック（中心トラック）
にランダムデータを書き込む
S24
K=0
S25
P=P0+（K−1）×ΔP
S26
隣接トラックにインクリメントデータを書き込む
S27
テストトラックのランダムデータを再生
エラー　をモニタ
S28
エラーレートERR>10-2
No
Yes
S29
K=K+1
S30
Pset=P×0.8
エンド

[Drawing 7]

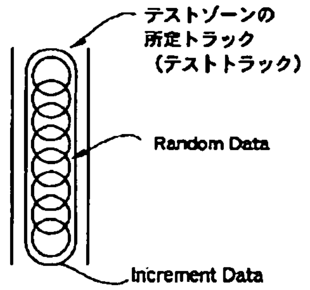

スタート
S31
P＝P0
S32
テストトラックを消去
S33
テストトラックにインクメントデータを書き込む
S34
J＝0
S35
P＝P0×0.6＋（J－1）×ΔP
S36
テストトラックにランダムデータを書き込む
S37
テストトラックのランダムデータを再生
エラー　をモニタ
S38
エラーレートERR＜10-2
No
Yes
J＝J＋1
S39
S40
Pow=P
1

[Drawing 8]

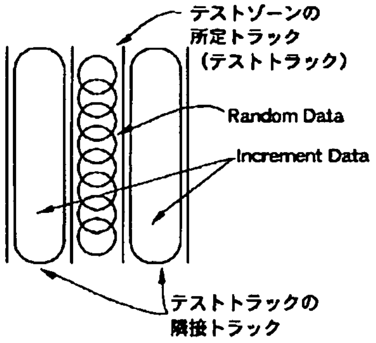

1
S41
P＝P0
S42
テストトラック及び隣接トラックを消去
S43
テストトラック（中心トラック）
にランダムデータを書き込む
S44
K＝0
S45
P＝P0＋（K－1）×ΔP
S46
隣接トラックにインクリメントデータを書き込む
S47
テストトラックのランダムデータを再生
エラー数をモニタ
S48
エラーレートERR＞10-2
No
Yes
K＝K＋1
S49
S50
Pera=P
S51
Pset=（Pow+Pera）/2
エンド

[Drawing 9]

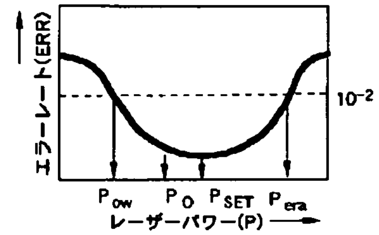
(a)


テストゾーンの
所定トラック
（テストトラック）
Random Data
Increment Data

(b)


テストゾーンの
所定トラック
（テストトラック）
Random Data
Increment Data
テストトラックの
隣接トラック

(c)



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the setting-out approach of the laser power of the laser beam which irradiates the optical disk [over-write / optical disk / in which an account rec/play student is possible], and, and, and the record regenerative apparatus of the optical disk [over-write / optical disk].

[0002]
[Description of the Prior Art] Conventionally, the optical disk as portable media which can rewrite data, such as a magneto-optic disk and a phase change disk, has spread. The thing of the so-called over write which carries out direct overwrite and rewrites data is known without eliminating the data which consider as such an optical disk, for example, have already been recorded.
[0003] Generally, when the writing of data is carried out, it is known for the optical disk in which such rewriting is possible that the power of the laser beam irradiated is related to the error rate of the data to record. For example, if the power of a laser beam is too low, the data already recorded will erase, the remainder will arise and high record of precision cannot be performed. Moreover, if the power of a laser beam is too high, a cross talk and cross IRESU with an adjoining truck will arise, and high record of precision cannot be performed.
[0004] Therefore, in the optical disk in which such rewriting is possible, the optimal power value of the laser beam which irradiates this disk is recorded on the ROM field established in the outermost periphery, the most-inner-circumference section, etc. In case the driver of this optical disk records data, it sets up the power of a laser beam based on this value.
[0005]
[Problem(s) to be Solved by the Invention] By the way, large capacity-ization of such an optical disk follows on progressing, for example, a laser beam short-wavelength-izes, a track pitch is becoming narrow or numerical aperture NA is becoming high. Therefore, the error rate of the record data based on the power of a laser beam has come to influence still more strictly.
[0006] Therefore, in the drive side, when writing in data, power control of a laser beam with a high precision was called for, and was required. Moreover, according to the effect of the proper of an environmental change, a drive, or a disk etc., controlling the power of the optimal laser beam appropriately was called for.
[0007] This invention is made in view of such the actual condition, and in case it records data on the optical disk [over-write / optical disk], it aims at offering the setting-out approach of the laser power which gives the optimal laser power, and a record regenerative apparatus.
[0008]
[Means for Solving the Problem] In order to solve an above-mentioned technical problem, the setting-out approach of the laser power concerning this invention On the predetermined truck which wrote data in the predetermined truck by predetermined laser power, and wrote in this data Data which are different by laser power fewer than the above-mentioned predetermined laser power are written in. The above-

mentioned data written in this predetermined truck are reproduced, and the error rate of the reproduced data is distinguished. When this error rate is larger than a predetermined value When laser power is raised, data are written in the above-mentioned predetermined truck and this error rate reaches a predetermined value It is characterized by setting the laser power at the time of writing in data as the data storage area of an optical disk at the laser power from which the error rate which becomes below this predetermined value based on the laser power at this time is obtained.

[0009] By the setting-out approach of this laser power, data are written in a predetermined truck by predetermined laser power, and data which are different by laser power fewer than this predetermined laser power on this predetermined truck are written in. And laser power is raised until the error rate of the reproduced data becomes below a predetermined value. When this error rate reaches a predetermined value, based on the laser power at this time, it is set as the laser power from which the error rate which becomes below this predetermined value is obtained.

[0010] Moreover, the setting-out approach of the laser power concerning this invention On the truck contiguous to the predetermined truck which wrote data in the predetermined truck by predetermined laser power, and wrote in this data The above-mentioned data which wrote in different data and were written in the predetermined truck are reproduced, and the error rate of the reproduced data is distinguished. When this error rate is smaller than a predetermined value When laser power is raised, data are written in the adjoining truck of the above-mentioned predetermined truck and this error rate reaches a predetermined value It is characterized by setting the laser power at the time of writing in data as the data storage area of an optical disk at the laser power from which the error rate which becomes below this predetermined value based on the laser power at this time is obtained.

[0011] By the setting-out approach of this laser power, data are written in a predetermined truck by predetermined laser power, and data which are different on the adjoining truck of this predetermined truck are written in. And data are written for laser power in the adjoining truck of a raising lever until the error rate of the data which reproduced the predetermined truck becomes below a predetermined value. When this error rate reaches a predetermined value, based on the laser power at this time, it is set as the laser power from which the error rate which becomes below this predetermined value is obtained.

[0012] A record playback means by which laser power is adjustable and, as for the record regenerative apparatus concerning this invention, carries out record and playback of data to an optical disk, An error rate detection means to detect the error rate of the data which the above-mentioned record playback means reproduced, Data which are different by laser power fewer than the above-mentioned predetermined laser power are written in the predetermined truck which wrote data in the predetermined truck by predetermined laser power, and wrote in this data. The above-mentioned data written in this predetermined truck are reproduced, and the error rate of the reproduced data is distinguished. When this error rate is larger than a predetermined value When laser power is raised, data are written in the above-mentioned predetermined truck and this error rate reaches a predetermined value It is characterized by equipping the data storage area of an optical disk with the setting-out means of the laser power which sets up the laser power at the time of writing in data at the laser power from which the error rate which becomes below this predetermined value based on the laser power at this time is obtained.

[0013] In this record regenerative apparatus, data are written in a predetermined truck by predetermined laser power, and data which are different by laser power fewer than this predetermined laser power on this predetermined truck are written in. And laser power is raised until the error rate of the reproduced data becomes below a predetermined value. When this error rate reaches a predetermined value, based on the laser power at this time, it is set as the laser power from which the error rate which becomes below this predetermined value is obtained.

[0014] Moreover, a record playback means by which laser power is adjustable and, as for the record regenerative apparatus concerning this invention, carries out record and playback of data to an optical disk, An error rate detection means to detect the error rate of the data which the above-mentioned record playback means reproduced, On the truck contiguous to the predetermined truck which wrote data in the predetermined truck by predetermined laser power, and wrote in this data The above-mentioned data which wrote in different data and were written in this predetermined truck are reproduced, and the error rate of the reproduced data is distinguished. When this error rate is smaller than a predetermined value When laser power is raised, data are written in the adjoining truck of the above-mentioned predetermined truck and this error rate reaches a predetermined value It is characterized by equipping the data storage area of an optical disk with the setting-out means of the laser power which sets up the laser power at the time of writing in data at the laser power from which the error rate which becomes below this predetermined value based on the laser power at this time is obtained.

[0015] In this record regenerative apparatus, data are written in a predetermined truck by predetermined laser power, and data which are different on the adjoining truck of this predetermined truck are written in. And data are written for laser power in the adjoining truck of a raising lever until the error rate of the data which reproduced the predetermined truck becomes below a predetermined value. When this error rate reaches a predetermined value, based on the laser power at this time, it is set as the laser power from which the error rate which becomes below this predetermined value is obtained.

[0016]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing.

[0017] As a gestalt of operation of this invention, the setting-out approach of the laser power in the case of recording data on a magneto-optic disk and a record regenerative apparatus are explained.

[0018] As magneto-optic-disk D is shown in drawing 1 , the control truck TCR is established in the outermost periphery and most-inner-circumference side. This control truck TCR consists of RAM fields which are the ROM field and the field which can be written in which is a read-only field. The initial value of the laser power at the time of writing in data is recorded on the ROM field of the control truck TCR. Moreover, the data pattern used in case laser power is set up is recorded on this ROM field. The management data called the so-called TOC (TableOf Contents) is recorded on the RAM field of the control truck TCR.

[0019] Inside these two control trucks TCR, the test zone ZT is formed, respectively. In setting up laser power at the time of writing in data, this test zone ZT is a field which carries out the so-called trial writing.

[0020] The data zone ZD is established in the field inserted into this test zone ZT. This data zone ZD is the record section of the main data, and this record section is divided into two or more zones. In addition, the test zone ZT mentioned above may be established in each zone of the data zone ZD.

[0021] In recording data on the data zone ZD of such a magneto-optic disk, the power of the laser beam which carries out outgoing radiation is set as an optimum value by the drive side, i.e., a record regenerative apparatus. At this time, a record regenerative apparatus makes trial writing the above-mentioned test zone TZ for data, and sets the power of a laser beam as it.

[0022] Drawing 2 is the block block diagram of the record regenerative apparatus 10 of the gestalt of operation of this invention.

[0023] The record regenerative apparatus 10 records data on magneto-optic-disk D by the field modulation technique, and records data with the so-called over write.

[0024] The optical pickup 11 to which the record regenerative apparatus 10 makes outgoing radiation of a laser beam etc. magneto-optic-disk D, The magnetic head 12 which impresses a record field to magneto-optic-disk D, and the I-V transformation-matrix circuit 13 which generates a regenerative signal MO, the push pull signal PP, focal error signal FE, etc. based on the output current from an optical pickup 11, The analog-to-digital (A/D) converter 14 which makes a regenerative signal MO binary, The PLL circuit 15 which generates a clock from the push pull signal PP, and the control information detector 16 which reproduces address information etc. from the push pull signal PP etc., The decoder 17 which performs detection processings of the error rate ERR of playback data, such as error correction processing of the regenerative signal MO made binary, The encoder 18 which adds an error correction sign etc. to record data, and the magnetic-head driver 19 which drives the magnetic head 12, It has with the controller 30 used as the servo circuit 20 which carries out various servo control, the laser control circuit 21 which controls the output power of a laser beam etc., and the main control section of this equipment.

[0025] An optical pickup 11 consists of semiconductor laser, an objective lens, a photodetector, etc., and carries out outgoing radiation of the laser to magneto-optic-disk D by predetermined power at the time of the writing of data. The power of the laser beam at this time is controlled by the laser control circuit 21. Moreover, as the recording method of this record regenerative apparatus 10 was mentioned above, the field modulation technique is used, and the laser beam is not modulated. In addition, the power of a laser beam is detected by the photodiode etc. as a quantity of light detecting signal, and it is controlled so that this detection value is fed back to the laser control circuit 21 and power becomes fixed.

[0026] Moreover, an optical pickup 11 detects the reflected light from magneto-optic-disk D by the photodetector at the time of read-out of data, and supplies the various regenerative currents to the I-V transformation-matrix circuit 13.

[0027] The magnetic head 12 is driven by the magnetic-head driver 19, and impresses the field of N or S to magneto-optic-disk D at the time of record of data. This magnetic head 12 is arranged so that it may counter on both sides of an optical pickup 11 and magneto-optic-disk D, for example, it moves with migration of the direction of a path of an optical pickup according to a thread device etc.

[0028] The I-V transformation-matrix circuit 13 transforms the current output from a photodetector into a voltage signal, and outputs the push pull signal PP used for detection of the regenerative signal of the main data, the becoming regenerative signal MO, focal error signal FE used for a focus servo, and a tracking error and address information.

[0029] A/D converter 14 samples a regenerative signal MO based on the clock supplied from the PLL circuit 15, and makes this regenerative signal MO binary. A/D converter 14 supplies this regenerative signal MO made binary to a decoder 17.

[0030] The push pull signal PP is supplied, and from this push pull signal PP, the PLL circuit 15 detects the clock mark prepared in magneto-optic-disk D, and reproduces a clock. The clock generated in this PLL circuit 15 is supplied to A/D converter 14, and is used as a synchronizing signal of a regenerative signal MO. Moreover, this clock is supplied to the control information detector 16, and is used as a bit timing signal of detection of the address at the time of playback or record, or record of data.

[0031] The push pull signal PP and a clock are supplied, and the control information detector 16 reproduces address information etc. Moreover, the control information detector 16 generates the bit timing signal which is record of the main data, or a reproductive timing signal, and supplies it to a decoder 17, an encoder 18, and a controller 30.

[0032] A decoder 17 performs the recovery processing of a regenerative signal MO and error correction processing which were supplied from A/D converter 14 and which were made binary based on the bit timing signal from the control information detector 16 etc., and supplies the data with which the error correction etc. was given to a controller 30. Moreover, a decoder 17 asks for the error rate ERR of the data reproduced from the error correction sign, and supplies this error rate ERR to a controller 30.

[0033] An encoder 18 performs modulation processing of the data for recording on magneto-optic-disk D supplied from a controller 30, attached processing of an error correction sign, etc., and supplies them to the magnetic-head driver 19. At this time, an encoder 18 performs predetermined processing based on the bit timing signal supplied from the control information detector 16.

[0034] The magnetic-head driver 19 drives the magnetic head 12, and performs a magneto-optic recording to magneto-optic-disk D with the laser beam which carries out outgoing radiation from an optical pickup 11.

[0035] The servo circuit 20 drives a focal driver etc. and makes the laser which carries out outgoing radiation to magneto-optic-disk D from an optical pickup 11 focus on a truck based on focal error signal FE. Moreover, based on the address information from the push pull signal PP and a controller 30 etc., the servo circuit 20 drives a tracking driver, and it controls an optical pickup 11 so that the laser beam which carries out outgoing radiation to magneto-optic-disk D serves as a truck from an optical pickup 11 just on a predetermined truck. The laser control circuit 21 performs servo control of the laser power of the laser beam in which an optical pickup 11 carries out outgoing radiation based on the quantity of light detecting signal fed back from an optical pickup 11, and it controls it so that the laser power of the laser beam irradiated by magneto-optic-disk D becomes fixed. Moreover, the laser power signal P whose laser control circuit 21 is the control signal of a controller 30 to laser power is supplied. The laser control circuit 21 controls the power of a laser beam based on this laser power signal P to become the optimal power.

[0036] A controller 30 acquires the data which perform an exchange of a host computer, data, and a command using SCSI (Small Computer Systems Interface) etc., and supply the data recorded on an encoder 18, and are reproduced from a decoder 17. Moreover, a controller 30 performs control of the servo circuit 20 etc., and carries out an optical pickup 11 for a track jump etc. to the truck which records data.

[0037] Moreover, in recording data on the data zone of magneto-optic-disk D, a controller 30 sets the power of the laser beam which carries out outgoing radiation as an optimum value, and supplies it to the laser control circuit 21 by making laser power used as this optimum value into the setting-out laser power PSET. At this time, a record regenerative apparatus makes trial writing the test zone of magneto-optic-disk D for data, and sets the power of a laser beam as it.

[0038] Setting-out processing of the laser power by the controller 30 of this record regenerative apparatus 10 is explained below.

[0039] First, the 1st example of setting out which the controller 30 of the record regenerative apparatus 10 performs is explained using the flow chart of drawing 3 etc.

[0040] A controller 30 performs processing from step S11 shown in drawing 3 for every fixed period, after this record regenerative apparatus 10 is loaded with magneto-optic-disk D or being loaded with magneto-optic-disk D, and it sets up the laser power PSET at the time of recording data on a data zone.

[0041] In step S11, a controller 30 reproduces the control truck of magneto-optic-disk D, acquires the value P0 of the initialization laser power currently recorded on this control truck, and sets the laser power signal P supplied to the laser control circuit 21 as this P0. In addition, this initialization laser power P0 may acquire what reproduces magneto-optic-disk D, and does not acquire, for example, is memorized as a value of a proper for the controller 30. Moreover, when a controller 30 sets up the laser power PSET for every fixed period, the laser power PSET set up previously may be set up as a laser power signal P.

[0042] Then, in step S12, the data pattern of "00" is written in the predetermined truck of the test zone of magneto-optic-disk D, i.e., the test truck which performs trial writing by the following processings. That is, the data currently recorded on this test truck are eliminated. The value of the laser power signal P at this time is the initialization laser power P0 set up previously.

[0043] Then, in step S13, increment data (Increment Data) in which a data value carries out a simple increment on this test truck are written in. The value of the laser power signal P at this time is the initialization laser power P0. In addition, what is beforehand recorded on the controller 30, the control truck of magneto-optic-disk D, etc. may be used for this increment data. Moreover, you may be data of not only increment data but arbitration.

[0044] Then, in step S14, Variable J is set as 0.

[0045] Then, in step S15, the value of the laser power signal P is set as P=P0x0.6+(J-1) xdeltaP. Here, the value is not limited that 0.6 which is the multiplier of P0 should just be the value which straddles a predetermined threshold when the laser power signal P is gone up in judging the error rate ERR at step S18 mentioned later. Moreover, deltaP judged the error rate ERR at step S18 mentioned later, when this error rate ERR is higher than a predetermined threshold, is a multiplier for raising the leather power P when updating the laser power signal P, for example, has set it to about P0 / 100.

[0046] Then, in step S16, random data (Random Data) are written in a test truck by the laser power set up at step S15. Let this random data be random data to the increment data currently recorded previously. By writing in random data at this step S16, as shown in the test truck which is a predetermined truck of a test zone at drawing 4 (a), random data are overwritten on increment data.

[0047] Then, in step S17, the random data written in this test truck are reproduced, and the monitor of the error rate ERR of this playback data is carried out. This error rate ERR is supplied to a controller 30, when a decoder 17 detects an error correction sign etc.

[0048] Then, in step S18, it judges whether the error rate ERR which carried out the monitor became lower than a predetermined threshold. For example, it judges whether the error rate ERR became lower than 10-2. When the error rate ERR is not lower than a predetermined threshold, it progresses to step S19, 1 is added to the value of J, and the laser power signal P of step S15 is set up. That is, when the error rate ERR is not lower than a predetermined threshold, the increment in the specified quantity of the value of the laser power signal P is carried out, and the processing from step S15 is repeated.

[0049] Moreover, when the error rate ERR becomes lower than a predetermined threshold, it progresses to step S20.

[0050] The BAKETO curve which shows the relation of the error rate ERR to laser power as shown in drawing 4 (b) can be obtained by repeating processing of decision of this step S18, and carrying out the monitor of the error rate ERR here.

[0051] Then, in step S20, the value which multiplied the predetermined multiplier by the laser power POW when the error rate ERR reaches a predetermined threshold is set up as laser power PSET at the time of recording data on a data zone, and processing is ended. Here, as shown in the BAKETO curve of drawing 4 (b), a predetermined multiplier is multiplied by this POW, because the laser power from which the error rate ERR serves as the minimum is in the place to which specified quantity laser power was made to increase to the laser power of the error rate ERR of a predetermined threshold. This multiplier is 1.2.

[0052] By processing of step S11 to the above step S20, the optimal laser power can be set up by the controller 30.

[0053] In addition, the random data recorded at step S16 may be used as random data which are different whenever it updates the laser power signal P.

[0054] Next, the 2nd example of setting out which the controller 30 of the record regenerative apparatus 10 performs is explained using the flow chart of drawing 5 etc.

[0055] A controller 30 performs processing from step S21 shown in every fixed period and drawing 5, after this record regenerative apparatus 10 is loaded with magneto-optic-disk D or being loaded with magneto-optic-disk D, and it sets up the laser power PSET at the time of recording data on a data zone.

[0056] In step S21, a controller 30 reproduces the control truck of magneto-optic-disk D, acquires the value P0 of the initialization laser power currently recorded on this control truck, and sets the laser power signal P supplied to the laser control circuit 21 as this P0. In addition, this initialization laser power P0 may acquire what reproduces magneto-optic-disk D, and does not acquire, for example, is memorized as a value of a proper for the controller 30. Moreover, when a controller 30 sets up the laser power PSET for every fixed period, the laser power PSET set up previously may be set up as a laser power signal P.

[0057] Then, in step S22, the data pattern of "00" is written in the truck of both the sides contiguous to a test truck and this test truck. That is, the data currently recorded on the truck contiguous to this test truck and this test truck are eliminated. The value of the laser power signal P at this time is the initialization laser power P0 set up previously.

[0058] Then, in step S23, random data are written in this test truck, i.e., the eliminated truck based on [of three trucks] inner. This random data is random data to the increment data written in the truck contiguous to the test truck mentioned later. The value of the laser power signal P at the time of writing in random data is the initialization laser power P0.

[0059] Then, in step S24, Variable K is set as 0.

[0060] Then, in step S25, the value of the laser power signal P is set as P=P0+(K-1) xdeltaP. Here, deltaP judged the error rate ERR at step S28 mentioned later, when this error rate ERR is lower than a predetermined threshold, is a multiplier for raising the leather power P when updating the laser power signal P, for example, has set it to about P0 / 100.

[0061] Then, in step S26, increment data are written in the truck of both the sides contiguous to a test truck by the laser power set up at step S25. In addition, what is beforehand recorded on the controller 30, the control truck of magneto-optic-disk D, etc. may be used for this increment data. Moreover, you may be data of not only increment data but arbitration.

[0062] By writing in an increment at this step S26, as shown in the test truck which is a predetermined truck of a test zone at drawing 6 (a), increment data are written in the truck contiguous to the test truck with which random data are written in and this random data is written in.

[0063] Then, in step S27, the random data written in this test truck, i.e., a main truck, are reproduced, and the monitor of the error rate ERR of this playback data is carried out. This error rate ERR is supplied to a controller 30, when a decoder 17 detects an error correction sign etc.

[0064] Then, in step S28, it judges whether the error rate ERR which carried out the monitor became higher than a predetermined threshold. For example, it judges whether the error rate ERR became higher than 10-2. When the error rate ERR is not higher than a predetermined threshold, it progresses to step S29, 1 is added to the value of K, and the laser power signal P of step S25 is set up. That is, when the error rate ERR is not higher than a predetermined threshold, the increment in the specified quantity of the value of the laser power signal P is carried out, and the processing from step S25 is repeated.

[0065] Moreover, when the error rate ERR becomes higher than a predetermined threshold, it progresses to step S30.

[0066] The BAKETO curve which shows the relation of the error rate ERR to laser power as shown in drawing 6 (b) can be obtained by repeating processing of decision of this step S28, and carrying out the monitor of the error rate ERR here.

[0067] Then, in step S30, the value which multiplied the predetermined multiplier by the laser power Pera when the error rate ERR reaches a predetermined threshold is set up as laser power PSET at the time of recording data on a data zone, and processing is ended. Here, as shown in the BAKETO curve of drawing 6 (b), a predetermined multiplier is multiplied by this Pera, because the laser power from which the error rate ERR serves as the minimum is in the place which decreased specified quantity laser power to the laser power of the error rate ERR of a predetermined threshold. This multiplier is 0.8.

[0068] By processing of step S21 to the above step S30, the optimal laser power can be set up by the controller 30.

[0069] Next, the 3rd example of setting out which the controller 30 of the record regenerative apparatus 10 performs is explained using the flow chart of drawing 7 and drawing 8 etc.

[0070] A controller 30 performs processing from step S31 shown in every fixed period and drawing 7, after this record regenerative apparatus 10 is loaded with magneto-optic-disk D or being loaded with magneto-optic-disk D, and it sets up the laser power PSET at the time of recording data on a data zone.

[0071] In step S31, a controller 30 reproduces the control truck of magneto-optic-disk D, acquires the value P0 of the initialization laser power currently recorded on this control truck, and sets the laser power signal P supplied to the laser control circuit 21 as this P0. In addition, this initialization laser power P0 may acquire what reproduces magneto-optic-disk D, and does not acquire, for example, is memorized as a value of a proper for the controller 30. Moreover, when a controller 30 sets up the laser power PSET for every fixed period, the laser power PSET set up previously may be set up as a laser power signal P.

[0072] Then, in step S32, the data pattern of "00" is written in a test truck. That is, the data currently recorded on this test truck are eliminated. The value of the laser power signal P at this time is the initialization laser power P0 set up previously.

[0073] Then, in step S33, for example, increment data are written in this test truck. The value of the laser power signal P at this time is the initialization laser power P0. In addition, what is beforehand recorded on the controller 30, the control truck of magneto-optic-disk D, etc. may be used for this increment data. Moreover, you may be data of not only increment data but arbitration.

[0074] Then, in step S34, Variable J is set as 0.

[0075] Then, in step S35, the value of the laser power signal P is set as P=P0x0.6+(J-1) xdeltaP. Here, when 0.6 which is the multiplier of P0 judges the error rate ERR at step S38 mentioned later, if it is the value which straddles a predetermined threshold when the laser power signal P is gone up, ** and its value will not be limited. Moreover, deltaP judged the error rate ERR at step S38 mentioned later, when this error rate ERR is higher than a predetermined threshold, is a multiplier for raising the leather power P when updating the laser power signal P, for example, has set it to about P0 / 100.

[0076] Then, in step S36, random data are written in a test truck by the laser power set up at step S35.

Let this random data be random data to the increment data currently recorded previously. Moreover, this random data may be used as random data which are different whenever it updates the laser power signal P.
[0077] By writing in random data at this step S36, as shown in the test truck which is a predetermined truck of a test zone at drawing 9 (a), random data are overwritten on increment data.
[0078] Then, in step S37, the random data written in this test truck are reproduced, and the monitor of the error rate ERR of this playback data is carried out. This error rate ERR is supplied to a controller 30, when a decoder 17 detects an error correction sign etc.
[0079] Then, in step S38, it judges whether the error rate ERR which carried out the monitor became lower than a predetermined threshold. For example, it judges whether the error rate ERR became lower than 10-2. When the error rate ERR is not lower than a predetermined threshold, it progresses to step S39, 1 is added to the value of J, and the laser power signal P of step S35 is set up. That is, when the error rate ERR is not lower than a predetermined threshold, the increment in the specified quantity of the value of the laser power signal P is carried out, and the processing from step S35 is repeated.
[0080] Moreover, when the error rate ERR becomes lower than a predetermined threshold, it progresses to step S40.
[0081] Then, in step S40, laser power when the error rate ERR reaches a predetermined threshold is set up as POW. Here, this laser power POW is given as a value on threshold 10-2 of the BAKETO curve shown in drawing 9 (c).
[0082] Then, in step S41 shown in drawing 8 , a controller 30 sets the value of the laser power signal P as the initialization laser power P0 again.
[0083] Then, in step S42, the data pattern of "00" is written in the truck of both the sides contiguous to a test truck and this test truck. That is, the data currently recorded on the truck contiguous to this test truck and this test truck are eliminated. The value of the laser power signal P at this time is the initialization laser power P0.
[0084] Then, in step S43, random data are written in this test truck, i.e., the eliminated truck based on [of three trucks] inner. This random data is random data to the increment data written in the truck contiguous to the test truck mentioned later. The value of the laser power signal P at the time of writing in random data is the initialization laser power P0.
[0085] Then, in step S44, Variable K is set as 0.
[0086] Then, in step S45, the value of the laser power signal P is set as P=P0+(K-1) xdeltaP. Here, deltaP judged the error rate ERR at step S48 mentioned later, when this error rate ERR is lower than a predetermined threshold, is a multiplier for raising the leather power P when updating the laser power signal P, for example, has set it to about P0 / 100.
[0087] Then, in step S46, increment data are written in the truck of both the sides contiguous to a test truck by the laser power set up at step S45.
[0088] By writing in an increment at this step S46, as shown in the test truck which is a predetermined truck of a test zone at drawing 9 (b), increment data are written in the truck contiguous to the test truck with which random data are written in and this random data is written in.
[0089] Then, in step S47, the random data written in this test truck, i.e., a main truck, are reproduced, and the monitor of the error rate ERR of this playback data is carried out.
[0090] Then, in step S48, it judges whether the error rate ERR which carried out the monitor became higher than a predetermined threshold. The threshold at this time is the same as the threshold at the time of judging at step S38. When the error rate ERR is not higher than a predetermined threshold, it progresses to step S49, 1 is added to the value of K, and the laser power signal P of step S45 is set up. That is, when the error rate ERR is not higher than a predetermined threshold, the increment in the specified quantity of the value of the laser power signal P is carried out, and the processing from step S45 is repeated.
[0091] Moreover, when the error rate ERR becomes higher than a predetermined threshold, it progresses to step S50.
[0092] Then, in step S50, laser power when the error rate ERR reaches a predetermined threshold is set

up as Pera. Here, this laser power Pera is given as a value on threshold 10-2 of the BAKETO curve shown in drawing 9 (c).

[0093] And in step S51, the middle value of the laser power Pow for which it asked at step S40, and the laser power Pera for which it asked at step S50 is calculated, this value is set up as laser power PSET at the time of recording data on a data zone, and processing is ended.

[0094] By processing of step S31 to the above step S51, the optimal laser power can be set up by the controller 30.

[0095] as mentioned above, in the record regenerative apparatus 10, a laser beam can be set as the optimal power, therefore an error rate is low -- data logging can be carried out. Moreover, even if record environmental influence differs, it is recordable by the optimal laser power with this record regenerative apparatus 10. Furthermore, data write, it can remain and a cross talk, cross erasion, etc. can be lost. Moreover, breakage of the disk by laser power being too strong etc. is avoidable.

[0096] In addition, although it explained that a decoder 17 detected the error rate ERR from an error correction sign in the gestalt of this operation, when the controller 30 has the memory which records a data pattern and is reproduced for example, by comparing playback data after not performing an error correction but recording as the data before record, you may not ask for the error rate ERR and the detection approach of the error rate ERR is not limited.

[0097] Moreover, in the gestalt of operation, although the setting-out approach of the laser power applied to the magneto-optic disk was explained, as long as this invention is an optical disk which records data not only with the case of a magneto-optic disk but with an over write, a medium is not limited, for example, may be applied to a phase change disk etc.

[0098]

[Effect of the Invention] By the setting-out approach of the laser power concerning this invention, data are written in a predetermined truck by predetermined laser power, and data which are different by laser power fewer than this predetermined laser power on this predetermined truck are written in. And laser power is raised until the error rate of the reproduced data becomes below a predetermined value. When this error rate reaches a predetermined value, based on the laser power at this time, it is set as the laser power from which the error rate which becomes below this predetermined value is obtained.

[0099] By this, even if record environmental influence differs by the setting-out approach of the laser power concerning this invention, it can record by the optimal laser power, and the error rate of the recorded data can be made low. Moreover, by the setting-out approach of the laser power concerning this invention, it is direct and laser power with a high precision can be set up.

[0100] Moreover, by the setting-out approach of the laser power concerning this invention, data are written in a predetermined truck by predetermined laser power, and data which are different on the adjoining truck of this predetermined truck are written in. And data are written for laser power in the adjoining truck of a raising lever until the error rate of the data which reproduced the predetermined truck becomes below a predetermined value. When this error rate reaches a predetermined value, based on the laser power at this time, it is set as the laser power from which the error rate which becomes below this predetermined value is obtained.

[0101] By this, even if record environmental influence differs by the setting-out approach of the laser power concerning this invention, it can record by the optimal laser power, and the error rate of the recorded data can be made low. Moreover, by the setting-out approach of the laser power concerning this invention, it is direct and laser power with a high precision can be set up.

[0102] In the record regenerative apparatus concerning this invention, data are written in a predetermined truck by predetermined laser power, and data which are different by laser power fewer than this predetermined laser power on this predetermined truck are written in. And laser power is raised until the error rate of the reproduced data becomes below a predetermined value. When this error rate reaches a predetermined value, based on the laser power at this time, it is set as the laser power from which the error rate which becomes below this predetermined value is obtained.

[0103] By this, even if record environmental influence differs in the record regenerative apparatus concerning this invention, it can record by the optimal laser power, and the error rate of the recorded data can be made low. Moreover, in the record regenerative apparatus concerning this invention, it is direct and laser power with a high precision can be set up.

[0104] Moreover, in the record regenerative apparatus concerning this invention, data are written in a predetermined truck by predetermined laser power, and data which are different on the adjoining truck of this predetermined truck are written in. And data are written for laser power in the adjoining truck of a raising lever until the error rate of the data which reproduced the predetermined truck becomes below a predetermined value. When this error rate reaches a predetermined value, based on the laser power at this time, it is set as the laser power from which the error rate which becomes below this predetermined value is obtained.

[0105] By this, even if record environmental influence differs in the record regenerative apparatus concerning this invention, it can record by the optimal laser power, and the error rate of the recorded data can be made low. Moreover, in the record regenerative apparatus concerning this invention, it is direct and laser power with a high precision can be set up.

[Translation done.]